



Suitability of Spokane River data for fingerprinting

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Problem

- Where are the PCBs in the Spokane River coming from?
- Many ways to answer this:
 - Sampling of suspected sources
 - Mass balance
 - Water quality modeling
 - Fingerprinting

Fingerprinting

- Primary sources
 - Fingerprints might resemble unweathered Aroclors
- Secondary sources
 - Fingerprints might resemble weathered Aroclors
 - Fingerprints might include some non-Aroclor congeners
- Weathering processes can include:
 - Anaerobic dechlorination might implicate sewers/groundwater
 - Cytochrome P450 metabolism is expected in organisms; might be able to correct for this to identify the parent Aroclors
 - Loss of high or low MW congeners due to volatilization, sorption
 - Other?????? Weathering is complex

Ways to do fingerprinting

- Positive Matrix Factorization
 - Requires larger data set, ideally >50 samples
- Multiple Linear Regression
- Both approaches require high quality data:
 - 1668 preferably
 - SPB-octyl column preferred
 - We have Aroclors measured on SGE-HT8 as well
 - Most congeners are detected
 - Detection limits are known

Available data sets

Matrix	Number of Samples	Study Year(s)	EIM Study ID	# NDs?	column	LOD	qual code/ detect flag
Bulk Atmospheric Deposition	12	2016 - 2017	BERA0013	ok	SPB	yes	yes
Macroinvertebrates	2	2018	not in EIM yet	ok	SPB	yes	yes
Biofilm	19	2018	not in EIM yet	ok	SPB	yes	yes
Sediment	3	2018	not in EIM yet	ok	SPB	yes	yes
Sediment	7	2003 - 2004	DSER0010*	??	SPB	missing	missing
Sediment (Urban Waters Program)	8	2013	SRUW-Spokane	ok	HT8	yes	yes
Sediment traps (suspended particulates)	4	2013	BERA0009	ok	HT8	yes	yes
Sediment traps (suspended particulates)	3	2015 - 2016	BERA0012	ok	SPB	yes	yes
Centrifuge sediment (suspended particulates)	4	2016 -2017	WHOB003	ok	SPB	yes	yes
Centrifuge sediment (suspended particulates)	3	2003	DSER0010*	not good	SPB	only for ND	flag
surface water CLAM	7	2013	BERA0009**	ok	HT8	yes	yes
Groundwater seeps (Urban Waters Program)	2	2013	SRUW-Spokane	ok	HT8	yes	yes
GE groundwater	8	2016		ok	SPB	yes	yes
2018 surface water	52	2018		ok	SPB	yes	yes
Prior surface water (blank study)	139	2014-2016		ok	SPB	yes	yes
Fish	71	2009-2016	various	ok	SPB	yes	yes
Stormwater	23	2007	BRWA0004	ok	DBS	yes	yes
Stormwater	254	2009-2016	various	ok	HT8	yes	yes
Kaiser Outfalls	143	2004-2011		ok	SPB	only for ND	yes
Kaiser Groundwater	>100?	2012		?	SPB	only for ND	yes
SCRWRF influent	150	2012-2018		ok	SPB	yes	yes
SCRWRF Effluent	28	2012-2018		ok	SPB	yes	yes
Discharger data from synoptic events				ok	SPB	yes	yes
Other WWTPs							

Data sets

- Plenty of data for PMF:
 - Surface water
 - Storm water
 - Fish
 - Kaiser outfall
 - Kaiser groundwater
 - SCRWRf influent
- Small data sets suitable for MLR:
 - Atmospheric deposition (probably lump with Green-Duwamish for PMF)
 - Sediment
 - Surface water CLAM
 - Biofilm
 - GE Groundwater
 - Groundwater seeps

Very preliminary findings

- Fish are dominated by Aroclors 1254 and 1260
 - These higher MW Aroclors bioaccumulate most effectively
- Fish and invertebrates show evidence of cytochrome P450 metabolism
 - But you can still recognize that 1254 and 1260 were the parent Aroclors
- Dechlorination might occur in Kaiser groundwater
 - might help us track this source;
 - no dechlorination signal observed in the surface water)
- Surface water Aroclors appear largely unweathered